

State of Illinois
Department of Transportation
Division of Highways
Springfield

SPECIFICATION
FOR
FAST-DRY PAVEMENT MARKING PAINT
WHITE AND YELLOW
(Chlorinated Rubber Type)

Serial Number: MI23-88

I. SCOPE

This specification covers white and yellow pavement marking paint intended for application on portland cement and bituminous surfaced roadways using conventional pavement marking equipment capable of atomizing and applying the materials at temperatures up to 90° C (194° F). The paint shall provide anchorage and refraction for glass beads applied to the wet film immediately following the atomizing equipment. The specification governs the types and qualities of ingredient materials, their respective proportions in the finished paint, the general methods of manufacture, the required characteristics of the finished paint, inspection procedures, and packaging requirements.

Any material delivered that fails to meet these specifications shall be disposed of by the vendor and immediately replaced with acceptable material entirely at his expense, including handling and transportation charges.

II. QUALITY REQUIREMENTS

The finished paint shall be formulated and manufactured from first-grade materials. It shall be free from defects and imperfections that might adversely affect the serviceability of the finished product. It shall be completely free from dirt and other foreign material and shall dry within the time specified to a good, tough, serviceable film. Antisettling and antiskinning agents and stabilizers shall be added, so that when stored in unopened shipping containers, it shall not thicken appreciably, skin over, liver, settle out appreciably, or cake badly. It shall be capable of outdoor storage in the shipping container for a period of at least 15 months, and any settled portion shall be easily brought back into suspension by hand mixing. When the settled portion is brought back into suspension in the vehicle, the paint shall be homogeneous and shall not show a viscosity change of more than 5 K.U. from the original viscosity. Any paint that has settled within the period of 15 months after delivery to the degree that the settled portion cannot be easily brought into suspension by hand mixing shall be disposed of by the vendor and immediately replaced with acceptable material entirely at his expense, including handling and transportation charges. The paint, when applied by spraying methods to a bituminous pavement, shall not be discolored due to the solvent action of the paint on the bituminous surface.

III. INGREDIENT MATERIALS

A. Titanium Dioxide.

This material shall comply with the latest revision of the Specification for Titanium Dioxide Pigments, ASTM D 476, Type II, Rutile. A notarized certificate of compliance from the pigment manufacturer shall be required.

B. Medium Chrome Yellow.

This material shall comply with the latest revision of the Specification for Chrome Yellow Pigments, ASTM D 211, Medium Chrome Yellow, Type III. A notarized certificate of compliance from the pigment manufacturer shall be required.

C. Calcium Carbonate.

This material shall comply with the latest revision of the Specification for Calcium Carbonate Pigments, ASTM D 1199, Type GC, Grade I, with minimum of 95% Calcium Carbonate or Type PC, minimum 98% Calcium Carbonate.

D. Magnesium Silicate.

This material shall comply with the latest revision of the Specification for Magnesium Silicate Pigments, ASTM D 605.

E. Zinc Oxide.

This material shall comply with the latest revision of the Specification for Zinc Oxide Pigments, ASTM D 79.

F. Chlorinated Rubber.

This material shall be a chlorinated natural rubber, prepared with suitable stabilizers, that when used will produce a stable paint formulation. The chlorinated rubber solution shall consist of the 20 centipoise type. The chlorinated rubber shall have the following properties:

Color (Gardner, 20% by weight in toluene) 4 maximum
Viscosity (20% by weight in toluene) 14-25 centipoises
Chlorine (by weight of rubber solids) 65% to 69%

G. Resin

The alkyd resin shall be a medium phthalic pure drying oil type reduced with VM&P naphtha to a nonvolatile content of not less than 60%. The oil shall be either soybean or linseed or a mixture of the two. The oil fatty acids shall have a minimum refractive number of 1.4660. The alkyd resin solution shall be compatible with and shall tolerate a 500% (by volume) dilution with VM&P naphtha.

I. Compatibility Test.

A solution containing 80 grams of 20 cp chlorinated rubber, 55 grams of chlorinated paraffin, 135 grams of 60% alkyd resin, 140 grams of methyl ethyl ketone, 100 grams of aliphatic thinner and 40 grams of toluene shall be clear, transparent and show no separation after 24 hours storage in a 3/4 full test tube at $26.7^{\circ} \pm 2.8^{\circ}$ C. ($80^{\circ} \pm 5^{\circ}$ F.).

2. Other Properties.

Based on the alkyd solids, the resin shall meet the following requirements:

Phthalic Anhydride, percent 33 to 37
Oil Acids, percent 48 to 55
Acid Number, maximum8
Ash Residue, percent maximum 0.05
Unsaponifiables, percent maximum1.0
Iodine Number of Fatty Acids, minimum..115

The alkyd resin (60% solids) when reduced with VM&P (to meet the latest revision of Federal Specification TTN 95) naphtha to 45% solids shall meet the following requirements:

Color, Gardner, maximum 9
Viscosity, Gardner D to H

H. Chlorinated Paraffin.

This material shall comply with the latest revision of Military Specification MIL C-429, Type I.

I. Organo Montmorillonite.

This pigment shall be finely divided organic derivatives of hydrous magnesium aluminum silicate minerals (Bentone 38 or equivalent).

J. Driers.

The lead and cobalt driers shall comply with the latest revision of the Specification for Liquid Paint Driers, ASTM D 600, Class A, B, or C.

K. Antiskinning Agent.

This material shall be an antiskinning agent suitable for use in paints.

L. Methyl Alcohol.

This material shall comply with the latest revision of the Specification for Methyl Alcohol, ASTM D 1152.

M. Methyl Ethyl Ketone.

This material shall comply with the latest revision of the Specification for Methyl Ethyl Ketone, ASTM D 740.

N. Aliphatic Thinner.

This material shall be an aliphatic solvent meeting the following requirements:

I. Distillation Range

IBP, minimum 190° F. (87.8° C.)
Dry Point, maximum 230° F. (110° C.)
KB, minimum 32
Appearance Clear and free of sediment

2. Or other aliphatic solvent compatible with this paint system with the approval of the Engineer of Materials and Physical Research.

O. Epoxy Resin.

This material shall be a condensation product of bisphenol-A and epichlorohydrin, contain no modifiers or diluents, and have the following properties:

Epoxide equivalent weight 180-220
Viscosity at 25° C. 100-160 poises
Hydrolyzable Chlorine 0.2% max.
Weight, pounds per gallon 9.55-9.75

P. Soya Lecithin.

This material shall be of suitable quality for use in the manufacturing of paint.

Q. Toluene

This material shall comply with the latest revision of the Specification for Industrial Grade Toluene, ASTM D 362.

All ingredient materials shall be delivered in the original containers and shall be used without adulteration.

The manufacturer shall furnish to the Department the batch formula which will be used in manufacturing the paint.

No change shall be made in this formula without prior approval by the Department and no change will be approved that adversely affects the quality or serviceability of the paint.

From 0.9 to 1.1% by weight of Organo Montmorillonite, based on weight of pigment, shall be added as a dispersing and suspending agent to prevent excessive settling. The Organo Montmorillonite shall be dampened with 33% of methyl alcohol containing 5% H₂O.

	<u>White</u>	<u>Yellow</u>
<u>Composition, % (by weight):</u>		
Pigment	52 - 54	53 - 55
Vehicle	46 - 48	45 - 47

The vehicle of both White and Yellow paint shall have a minimum non-volatile of 38.0%.

<u>Pigment, % (by weight):</u>	
Medium Chrome Yellow	min. 16
Titanium Dioxide Pigment	min. 16
Zinc Oxide Pigment min. 3	min. 3
Magnesium Silicate Pigment ... max. 43	max. 43
Calcium Carbonate Pigment ... max. 41	max. 41
Organo Montmorillonite 0.9 - 1.1	0.9 - 1.1

<u>Vehicle, % (by weight):</u>	<u>White and Yellow</u>
Alkyd Resin (60% solids)	min. 23.9
Chlorinated Rubber	min. 14.1
Chlorinated Paraffin	min. 9.7
Soya Lecithin	1.4
Lead Driers (24%)	0.3
Cobalt Driers (6%)	0.1
Antiskinning Agent	0.2
Epoxy Resin	0.4
Methyl Ethyl Ketone	24.8
Aliphatic Thinner	max. 17.7
Toluene	min. 7.1
Methyl Alcohol	0.4

Typical formulas which may serve as a guide for manufacture of the paint are as follows:

	<u>Pounds</u>	
	<u>White</u>	<u>Yellow</u>
Medium Chrome Yellow	105	
Titanium Dioxide	---	
Zinc Oxide	20	
Magnesium Silicate	260	
Calcium Carbonate	250	
Organo Montmorillonite	6	
Methyl Alcohol	2	
Alkyd Resin, 60% solids	135	
Chlorinated Rubber, 20 cps ...	80	
Chlorinated Paraffin	55	
Soya Lecithin	8	
24% Lead Drier	1.5	
6% Cobalt Drier	0.6	
Antiskinning Agent	1	
Epoxy Resin	2	
Aliphatic Thinner	100	
Methyl Ethyl Ketone	140	
Toluene	40	
	1206.1	1226.1

V. PAINT PROPERTIES

The paint shall have the following properties:

A. Pigment Composition.

Analysis of the extracted pigment shall conform to the following requirements:

	<u>White</u>	<u>Yellow</u>
Lead Chromate, %	---	min. 14
Titanium Dioxide, %	min. 15	---
Calcium Carbonate, %	max. 42	max. 42

B. Consistency.

This paint shall have a consistency of 76 K.U. \pm 6 K.U. The consistency shall be determined by a Stormer Viscosimeter with a paddle-type rotor at 25° C. (77° F.).

C. Fineness of Dispersion.

This paint shall have a fineness of dispersion of not less than 2 as determined on a Hegman gauge, having body dimensions 3/4" x 2 1/2" x 8" using the North Standard Scale 0-8 with path size of 1/2" x 6".

D. Color and Directional Reflectance.

The daylight directional reflectance of the paint (without glass spheres) shall not be less than 83% (white) and 50% (yellow) relative to magnesium oxide when tested in accordance with Federal Test Method Standard No. 141a, Method 6121. In addition, the color of the yellow paint shall visually match Color Number 33538 of Federal Standard 595a to the satisfaction of the Department. Small amounts of light-fast tinting pigments will be allowed to match the color standard.

E. Drying Time.

The paint shall have a no-pickup maximum drying time of 7 minutes, when tested according to ASTM D 711, using a wet film thickness of 0.015" and when applied and tested at 25° C. (77° F.).

The paint shall have a no-track maximum drying time of 3 minutes when applied at the manufacturer's recommended temperature and application rate.

F. Settling Test.

The paint shall, when tested for settling by ASTM Method D 1309 and evaluated by ASTM Method D 869, have a minimum acceptable rating of 6, and shall show no signs of significant deterioration of the vehicle system.

G. Flexibility and Adhesion.

A paint film of 0.015" wet film thickness shall be applied to a tin panel 3" x 5" weighing 0.39 to 0.51 lbs./sq. ft. previously cleaned with toluene and lightly buffed with steel wool. After drying in a horizontal position at a room temperature of $23^{\circ} \pm 1.1^{\circ}$ C. ($73.4 \pm 2^{\circ}$ F.) for eighteen hours, the panel shall be baked in an oven at $50^{\circ} \pm 2^{\circ}$ C. ($122^{\circ} \pm 3.6^{\circ}$ F.) for two hours, removed and allowed to cool to room temperature. It shall then be bent rapidly, with the painted surface uppermost, over a 1/2" mandrel and examined without magnification. The paint shall adhere firmly to the panel and any evidence of cracking or flaking of the film shall be cause for rejection of the paint.

H. Water Resistance.

The paint shall show no softening or blistering when tested in accordance with the procedure as outlined herein below:

(I) Panels

The panels used in this test shall be glass plates 4" x 8". They must be thoroughly cleaned with a suitable solvent and thoroughly dried before paint is applied.

(2) Procedure

The paint shall be applied to the panels to a wet film thickness of 0.015". Allow the paint film to dry in a horizontal position at a room temperature of $23 \pm 1.1^{\circ} \text{C}$. ($73.4^{\circ} \pm 2^{\circ} \text{F.}$) for 72 hours, protecting the same against the accumulation of dust; then immerse a portion of the paint film on the glass panels in distilled water at room temperature for 18 hours. Allow to air-dry for 2 hours and then examine.

VI. SAMPLING AND INSPECTION

A. Bid Sample.

The bidder shall, at the time his bid is submitted, forward to the Engineer of Materials and Physical Research, 126 East Ash Street, Springfield, Illinois 62706, for test purposes, two one-quart qualification samples of material representative of that which he proposes to produce.

The successful bidder shall furnish a list of the trade names and manufacturers and/or suppliers of the ingredient materials he proposes to use and a copy of his batching formula.

B. SAMPLING AND TESTING

Unless otherwise provided, all materials shall be sampled and tested in accordance with the latest published standard methods of the American Society for Testing and Materials, and revisions thereof, in effect on the date of the invitation for bids, where such standard methods exist. In case there are no ASTM Standards which apply, applicable standard methods of the American Association of State Highway and Transportation Officials, or of the Federal Government, or of other recognized standardizing agencies shall be used.

C. Inspection

The right is reserved to inspect the paint either at the place of manufacture or after its arrival at destination. If inspected at the place of manufacture, the manufacturer shall furnish such facilities as may be required for collecting and forwarding samples of ingredient materials and finished paint and for performing the inspection of the paint during the process of manufacture. Before manufacture of the paint is started, the ingredient materials shall be set aside at the manufacturer's plant and shall be sampled by an authorized representative of the Department. All materials represented by these samples shall be held until tests have been made and the materials found to comply with the requirements of the specifications. Approximately 30 days are required to test the ingredient materials. The Department has the option to waive inspection of ingredient materials. During the manufacturing operations, the Department's representative shall have free entry at all times to such parts of the plant as concern the manufacture of the paint. All tests will be made by and at the expense of the Department unless otherwise specified in the bid proposal.

VII. PACKAGING.

Unless otherwise directed, the paint shall be packaged and shipped in new 55-gallon removable white-head steel drums meeting the latest regulations of the Interstate Commerce Commission for shipping containers for this type of material. The opening in the drum shall be circular, and the diameter of the opening shall be substantially the diameter of the inside of the end of the drum. The drum shall be provided with gaskets of tubular neoprene construction and shall be completely airtight. The closure shall be securely attached to the drum by a bolt-action-type ring that shall enclose the edge of the lid and the chime of the drum. A lock nut shall be placed on the closure bolt between the free and threaded ends of the closure ring anchor. The closure bolt shall be tightened to a minimum of 40 ft. lbs. torque, and the lock nut shall be securely tightened against the threaded end of the anchor.

Fifty-five gallons of paint shall be placed in each drum, leaving approximately 2 inches of air space. The paint shall be measured by volume, the unit of measure being a gallon of 231 cubic inches at 25° C. (77° F.).

Each drum shall be stenciled on the removable head and on the side of each drum to show the kind of paint contained therein, the manufacturer's name, the purchase order number, the lot number, and the month and year the paint is packaged.

Effective October 1, 1988.

This specification supersedes Serial Number M123-87.
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M123-88